Groundwater recharge estimation in the Eden catchment, England considering the heterogeneous thickness of glacial till

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The superficial deposits in the Eden Catchment are highly heterogeneous; and the spatial distribution and thickness of glacial till control water and pollutant transfer to underlying groundwater system and affect the amount of groundwater recharge and the location it occurs. Traditionally the superficial deposits are subdivided into zones without considering the thickness information; and some efforts have been made to integrate the thickness information into the domain classification methods to estimate the groundwater recharge. These methods depend on expert judgement and different people could produce different results.

A new method was developed in this study to objectively estimate groundwater recharge and runoff considering the spatial distribution and thickness of glacial till. The SLiM was selected to simulate the runoff and recharge processes using readily available temporal and distributed meteorological factors and catchment characteristics. The glacial till were divided into five thickness classes, i.e., 0 – 2m, 2m – 5m, 5m – 10m , 10m – 30m, based on the observed results from a glacial till field experiment undertaken by BGS; and the reduction of recharge due to the presence of glacial till was identified based on Monte Carlo runs of SLiM. Modelled runoff hydrographs were compared with observed ones for calibration purpose. The results show that the measured recharge rate (1.16 – 1.28 mm day^{-1}) using tracer technique in the study area is within the range of estimated average recharge (0-1.45 mm day^{-1}). The recharge modelled can also reflect the characteristics of the temperate climates.

Since this method objectively relays on the datasets that are readily available, it can be easily transferred to other areas.